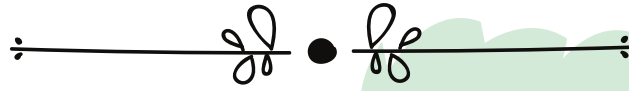




BIOHACK NOTES



# PHOTOSYNTHESIS IN HIGHER PLANTS

- BASED ON ACTIVE RECALL AND SPACED REPETITION
- TARGET 360/360 IN NEET BIOLOGY & 100/100 IN BOARDS!



**PARTH** GOYAL





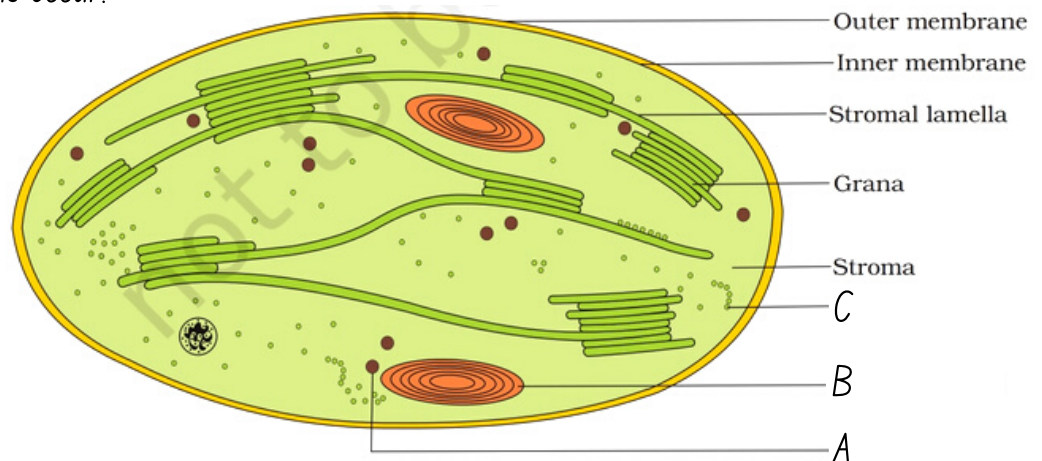
## • EARLY EXPERIMENTS

1. Photosynthesis is a \_\_\_\_\_ process.
2. KOH absorb \_\_\_\_\_
3. \_\_\_\_\_ performed a series of experiments revealing the essential role of air in growth of green plants.
4. Priestley discovered \_\_\_\_\_
5. Bell jar experiment was done by \_\_\_\_\_
6. Priestly used \_\_\_\_\_ plant.
7. Jan Ingenhousz showed that \_\_\_\_\_
8. Who showed that it is only the green part of the plants that could release oxygen ?
9. \_\_\_\_\_ provided evidence for production of glucose when plants grow.
10. Who showed glucose is usually stored as starch ?
11. \_\_\_\_\_ illuminated a green alga, \_\_\_\_\_, placed in a suspension of aerobic/anaerobic bacteria.
12. The first action spectrum of sunlight was described by \_\_\_\_\_
13. The first action spectrum resembles roughly the absorption spectrum of chl \_\_\_\_\_ and \_\_\_\_\_
14. A microbiologist, \_\_\_\_\_, based on his study on \_\_\_\_\_ and \_\_\_\_\_ bacteria, demonstrated that photosynthesis is essentially a light-dependent reaction.
15. \_\_\_\_\_ proved that the  $O_2$  evolved by the green plant comes from  $H_2O$ , not from carbon dioxide.

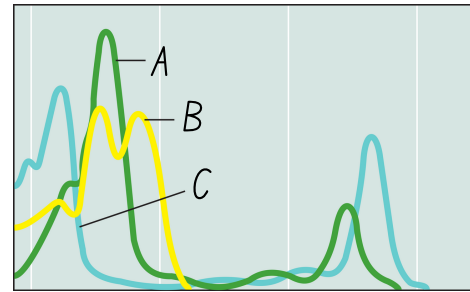


## • PHOTOSYNTHESIS PROPER

16. Chloroplasts align their flat surfaces parallel to the wall when given high/low light intensity.
17. There is a clear division of labour within the chloroplast. T/F
18. The membrane system is responsible for \_\_\_\_\_ and \_\_\_\_\_
19. In stroma, \_\_\_\_\_ reactions occur.
20. Identify the diagram and missing labelling A, B & C.



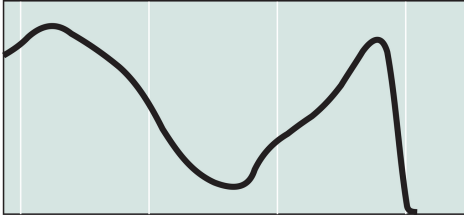
21. Identify the diagram and missing labelling A, B & C.



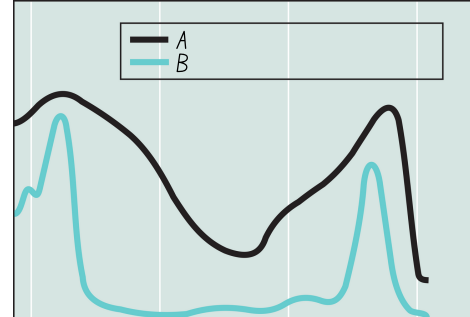
22. Colour in leaves is due to 4 pigments.

Name them and also their colour.

23. Identify the graph.



24. Identify A & B.



25. Wavelengths at which there is maximum absorption by chlorophyll \_\_\_\_, also shows higher rate of photosynthesis.

26. \_\_\_\_\_ is the chief pigment associated with photosynthesis.

27. Accessory pigments ex - (3)

28. Accessory pigment fxn (2)

29. Dark reaction is a photochemical phase. T/F

30. What four things happen in light reaction ?

31. LHC is made up of hundred of pigment bound to \_\_\_\_\_

32. LHC also called \_\_\_\_\_

33. In PSI, absorption peak is at \_\_\_\_\_ nm hence called \_\_\_\_\_

34. In PSII, absorption peak is at \_\_\_\_\_, hence called \_\_\_\_\_

35. Photosystems are named according to discovery/sequence of function.

36. Chl. a + LHC = PS T/F



## • ELECTRON TRANSPORT & CHEMIOSMOSIS

37. Light reaction follows \_\_\_\_ scheme. (NEET)

38. The splitting of water is associated with PSI/PSII.

39. PSII is located in the inner/outer side of the membrane of thylakoid.

40. Cyclic phosphorylation occurs in the \_\_\_\_\_ component of chloroplast.

41. I gave light at a wavelength of 690nm to a plant. Which phenomenon will be seen ?

Which PS will be functional here ? (NEET)

42. Both ATP and NADPH are synthesised in

Cyclic/Non-cyclic photophosphorylation. (NEET)



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43. Stromal lamellae lack \_\_\_\_\_ and \_\_\_\_\_
44. Sequence of flow of electrons across thylakoid membrane during in non-cyclic photophosphorylation is
45. The primary acceptor of an electron, located towards the inner/outer side of the membrane transfers its electron to an electron carrier/H carrier.
46. Relative concentration of protons in stroma and lumen is decreased by which 3 mechanisms?
47. CFI is embedded in the thylakoid membrane. T/F
48. \_\_\_\_\_ protrudes out of the thylakoid membrane.



## • CALVIN CYCLE, C<sub>4</sub> PATHWAY & PHOTORESPIRATION

49. The primary acceptor molecule of CO<sub>2</sub> is a 2 carbon compound making a 3 carbon compound.
50. First product of C<sub>4</sub> pathway is \_\_\_\_\_
51. First product of C<sub>3</sub> pathway is \_\_\_\_\_
52. The name of acceptor molecule is \_\_\_\_\_
53. The acceptor molecule is a ketose/aldose sugar.
54. Calvin cycle doesn't occur in C<sub>4</sub> plants. T/F
55. The 3 stages of Calvin cycle are
56. \_\_\_\_\_ is the most crucial step of the Calvin cycle.
57. Enzyme used in carboxylation is called \_\_\_\_\_
58. For 5 CO<sub>2</sub> molecules, how many ATP and NADPH will be needed to fix it ?
59. \_\_\_\_\_ is crucial for the cycle to continue uninterrupted.
60. C<sub>4</sub> pathway is found in plants adapted to \_\_\_\_\_ regions.
61. \_\_\_\_\_ anatomy of leaves is present in C<sub>4</sub> pathway.
62. In C<sub>4</sub> plants. \_\_\_\_\_ cells are present around vascular bundles.
63. The bundle sheath forms only one layer around the vascular bundle. T/F
64. Features of bundle sheath cells (3)
65. Ex of C<sub>4</sub> plant (2)
66. Hatch and Slack pathway is a non-cyclic process. T/F
67. In C<sub>4</sub> primary CO<sub>2</sub> acceptor is \_\_\_\_\_ and it is present in bundle sheath/mesophyll cells.
68. Analogue to RuBisCO in C<sub>4</sub> is \_\_\_\_\_
69. After OAA formation, it is converted into \_\_\_\_\_ or \_\_\_\_\_ in the mesophyll/bundle sheath cell.
70. In a bundle sheath cell, the acids are broken down into \_\_\_\_ carbon molecules.
71. PEP is regenerated in which cell?
72. Bundle sheath is rich in \_\_\_\_\_
73. In C<sub>4</sub> the Calvin pathway occurs in \_\_\_\_\_ cells.





74. Rubisco has a much greater affinity for  $O_2$  than  $CO_2$ . T/F
75. RuBP bind with  $O_2$  to form \_\_\_\_\_ and \_\_\_\_\_
76. The biological function of photorespiration is not known. T/F
77. At low  $CO_2$  concentrations, the photorespiration will increase. T/F
78. Which 3 organelles are involved in photorespiration?



## • FACTOR AFFECTING PHOTOSYNTHESIS

79. Blackman gave his law in the year \_\_\_\_\_.
80. Light is a frequent limiting factor in nature. T/F
81. Light saturation occurs at \_\_\_\_\_ % of full sunlight. (NEET)
82. There is a linear/parabolic/hyperbolic relation between incident light and  $CO_2$  fixation rates at low/high light intensities.
83. \_\_\_\_\_ is a major limiting factor for photosynthesis.
84.  $CO_2$  concentration in the atmosphere is between \_\_\_\_\_ and \_\_\_\_\_ %.
85. Increase in conc. Upto \_\_\_\_\_ % cause increase in  $CO_2$  fixation, beyond which it becomes damaging. (NEET)
86.  $C_4$  plant show saturation only beyond \_\_\_\_\_
87.  $C_3$  plant show saturation at \_\_\_\_\_
88. Examples of some greenhouse crops (2) (NEET)
89. Light reactions are temperature sensitive. T/F
90. Dark reactions are temperature controlled because \_\_\_\_\_
91.  $C_3$  plants have greater optimum temperature. T/F (NEET)
92. Temperate plants have higher optimum temperature than tropical plants. T/F
93. \_\_\_\_\_ and \_\_\_\_\_ hormones increase photosynthesis.
94. \_\_\_\_\_ hormone decreases photosynthesis.
95. Water has a direct/indirect effect.





# PHOTOSYNTHESIS IN HIGHER PLANTS

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ANSWERS

## • EARLY EXPERIMENTS

- 1) Physio-chemical
- 2) CO<sub>2</sub>
- 3) Joseph Priestly
- 4) Oxygen
- 5) Priestly
- 6) Mint
- 7) Sunlight is essential for photosynthesis
- 8) Jan Ingenhousz
- 9) Julius von Sachs
- 10) Julius von Sachs
- 11) T.W. Engelmann, cladophora, aerobic
- 12) T.W. Engelmann
- 13) a and b
- 14) Cornelius van Niel, purple and green bacteria
- 15) Cornelius van Niel

## • PHOTOSYNTHESIS PROPER

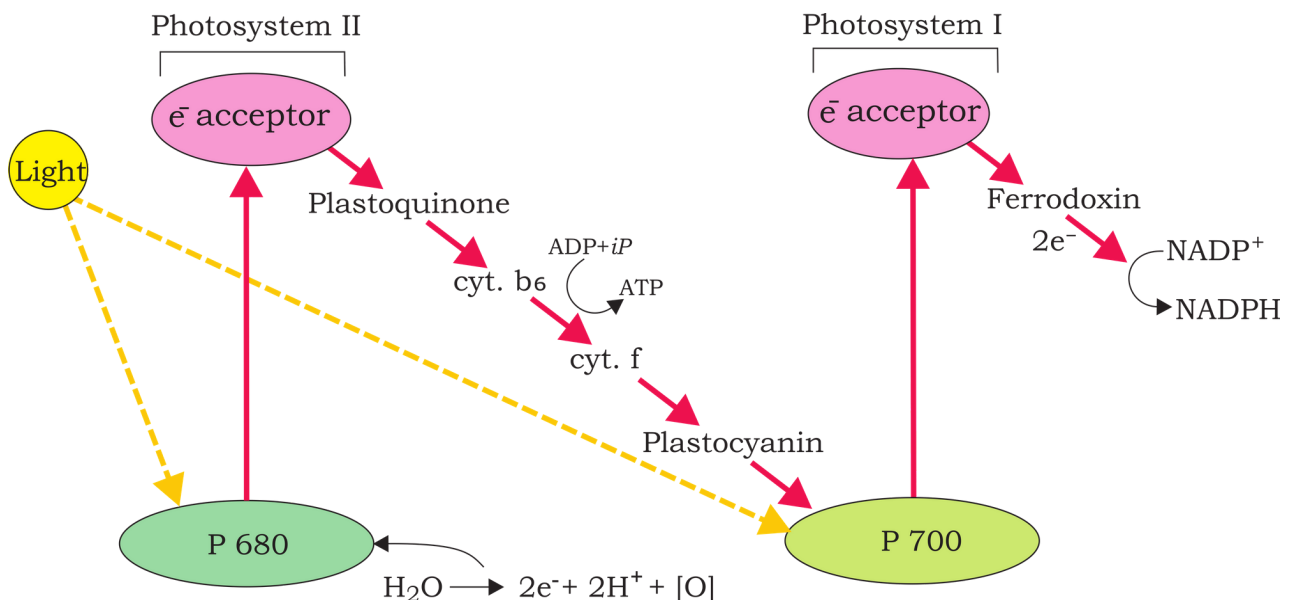
- 16) Low
- 17) T
- 18) Trapping light energy, synthesis of ATP and NADPH
- 19) Dark
- 20) Chloroplast,
  - A - Lipid droplet
  - B - Starch Granule
  - C - Ribosome

- 21) Absorbance of light by chloroplast pigment.  
A - Chl b, B - carotenoids, C - Chl a
- 22) Chlorophyll a (bright or blue green), chlorophyll b (yellow green), xanthophylls (yellow) and carotenoids (yellow to yellow-orange)
- 23) Rate of photosynthesis vs wavelength of light
- 24) A - rate of photosynthesis, B - Absorption
- 25) a
- 26) Chl a
- 27) Chl b, xanthophyll, carotenoids
- 28) Enable a wider range of wavelength of incoming light to be utilised, protect chlorophyll a from photo-oxidation.
- 29) F
- 30) light absorption, water splitting, oxygen release, and the formation of high-energy chemical intermediates

- 31) Proteins
- 32) Antennae
- 33) 700 nm, P700
- 34) 680 nm, P680
- 35) Discovery
- 36) T

## • ELECTRON TRANSPORT

- 37) Z
- 38) PSII
- 39) Inner
- 40) Stroma lamellae
- 41) Red drop effect, PS I will be functional
- 42) Non-cyclic
- 43) PSII and NADP reductase
- 44) Z scheme of light reaction



45) Outer, H carrier

#### 46) Chemiosmotic Hypothesis

- 1. Protons that are produced by the splitting of water on the inner side of the membrane accumulate within the lumen of the thylakoids.
- 2. As electrons move through the photosystems, protons are transported across the membrane. This happens because the primary acceptor of electron which is located towards the outer side of the membrane transfers its electron not to an electron carrier but to an H carrier.
- 3. Reduction of  $\text{NADP}^+$  to  $\text{NADPH} + \text{H}^+$ . These protons are also removed from the stroma.

47) F

48) CF<sub>I</sub>

#### • CALVIN CYCLE

49) F

50) OAA

51) PGA

52) RuBP

53) Ketose

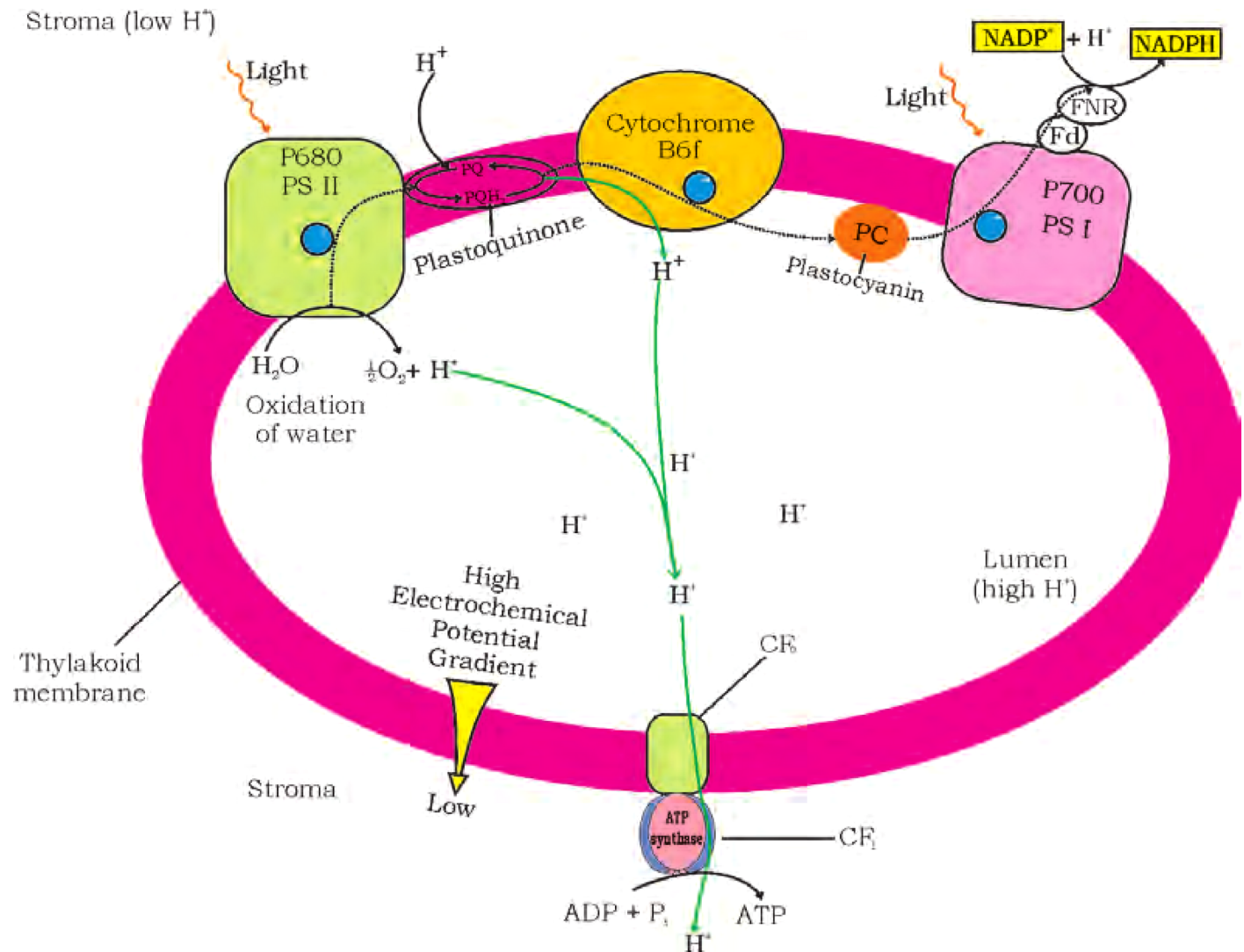
54) F

55) Carboxylation, Reduction, Regeneration

56) Carboxylation

57) RuBisCo

58) 15 ATP, 10 NADPH



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59) Regeneration of RuBP  
 60) Dry tropical  
 61) Kranz  
 62) Bundle sheath cells  
 63) F  
 64) Large on of chloroplast, thick walls impervious to gaseous exchange, no intercellular spaces  
 65) Maize and sorghum    66) F  
 67) PEP, mesophyll        68) PEPcase  
 69) Malic acid or aspartic acid  
 70) 3  
 71) Mesophyll cell  
 72) RuBisCO  
 73) Bundle sheath cell  
 74) F  
 75) Phosphoglycerate and Phosphoglycolate  
 76) T  
 77) F  
 78) Peroxisomes, mitochondria and chloroplast

## • FACTOR AFFECTING PHOTOSYNTHESIS

79) 1905  
 80) F  
 81) 10  
 82) Linear, low  
 83) CO<sub>2</sub>  
 84) 0.03-0.04  
 85) 0.05  
 86) 450  $\mu\text{L}^{-1}$   
 87) 360  $\mu\text{L}^{-1}$   
 88) Tomato and bell pepper  
 89) T  
 90) They are enzymatic  
 91) F  
 92) F  
 93) Cytokinin and Gibberellin  
 94) Absciscic acid  
 95) indirect



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